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The Effect of Triacontanol on the Growth and Development of Tabasco Pepper (Capsicum Frutescens L.).

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THE EFFECT OF TRIACONTANOL ON THE GROWTH AND DEVELOPMENT OF TABASCO PEPPER (*CAPSICUM FRUTESCENS* L.)

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ABSTRACT

An investigation was conducted to determine the effectiveness of a new formulation of triacontanol on the growth, water content, yield, early maturity, total number of fruits, fruit and leaf dry weight and the concentration of N, P, K, Ca, Mg, Zn, Cu and Fe in the leaves of Tabasco pepper plants (Capsicum frutescens L.) grown on olivier silt loam.

In the greenhouse experiment, 0.01 mg per liter of triacontanol applied at the rate of 15 ml and 10 ml to each Tabasco pepper seedling 18 and 43 days after planting, significantly increased the plant height and water content of 71 day old Tabasco pepper seedlings. Triacontanol at 0.001 mg per liter applied at the rate of 15 and 10 ml per container 11 and 46 days after planting significantly increased the dry weight of 118 day old rice (Oryza sativa L.) var. Saturn.

The 1.25 mg per liter treatment of triacontanol applied at the rate of 15 ml and 10 ml 11 and 46 days after planting significantly increased the height of 118 day old rice (Oryza sativa L.).

The 1.25 mg per liter of triacontanol applied at the rate of 25 ml per plant at transplanting significantly increased early maturity, total yield and the total number of fruits of Tabasco pepper grown in the field during the first summer. In the following summer the 1.25 mg per liter of triacontanol applied at the rate of 25 ml per plant at the time of transplanting and again at first bloom significantly increased early maturity, total yield, total number of fruits, height and diameter of Tabasco pepper plants.

Fish wash, 454 grams of Mackerel head soaked and washed in 2 liters of distilled water for 15 minutes, applied at the rate of 50 ml per plant

at the time of transplanting in the field during the first summer significantly increased early maturity, total yield, plant diameter and total number of fruits of Tabasco pepper. Similar results were obtained when 50 ml of fish wash were applied at the time of transplanting and again at first bloom in the following summer.

INTRODUCTION

In working with triacontanol, it has been found that the formulations of this alcohol is the limiting factor in research. Triacontanol has been proven to be a powerful plant growth regulator, insoluble in water but sparingly soluble in ethanol, benzene and chloroform.

In this experiment, a new formulation of triacontanol was tested. The activity of this formulation was tested on various mechanims related to the growth and development of Tabasco pepper (Capsicum frutescens L.)

Pepper is one of the important horticultural crop grown in the south and south-western United States. In Louisiana, particularly, peppers are hand harvested and it is a labor intensive operation. Any effort to increase the yield or to decrease the production cost per acre of peppers will be beneficial in the pepper business.

This study was conducted with the following objectives:

1. To determine the effectiveness of a new solution of triacontanol.
2. To find the concentration at which triacontanol will give the best response to the crops both in the greenhouse and field operation.
3. To increase the production and yield of Tabasco pepper (Capsicum frutescens L.) especially in the state of Louisiana.

LITERATURE REVIEW

In addition to the well known plant growth regulators such as auxin, gibberellic acid, cytokinin, abscisic acid and ethylene, there are a number of other less well known growth hormones of botanical origin. Included within the latter category would be a number of compounds which have been identified as aliphatic and aromatic carboxylic acids, N-heterocyclics, alcohols and terpenes (18, 43, 70, 78).

Garlic acid, an aromatic carboxylic acid has been proven to be a natural inhibitor in the flowering of Kalanchoe blossfeldiana L. under a long day condition (58). The compound 1-acetoxy-2, 4-dihydroxy-n-hepta deca-16-ene ($C_{19}H_{36}O_4$) isolated from avocado mesocarp has been shown to inhibit callus growth in soybean and elongation of wheat coleoptile (2). Aliphatic acids of C_2 to C_9 inhibit the germination of mustard (Sinapis alba L.) (57). Fatty alcohols of C_8 to C_{12} selectively kill or inhibit the terminal meristem of a wide variety of plants without damaging the auxillary meristems (78). The inhibitory effects of aliphatic acids and alcohols decreased with increasing carbon chains (78).

Triacontanol (1-hydroxytriacontane), an alcohol, has been isolated and identified by Chibnall and co-workers in 1933 (7). An alcohol extract from lucern wax (Medigo sativa L.), upon oxidation gave an acid with a melting point of 92.7-93.0^{o}F, resembling the melting point of triacontanoic acid. Upon reduction via iodide and treatment with light petroleum, another product is formed with a melting point of

65.5-65.8^{o}F, resembling the melting point of n-triacontane, a paraffin. Further analysis by crystal spacing and x-ray analysis, enabled them to identify the alcohol as 1-triacontanol (7).

Robinson (68) reported that triacontanol isolated from Arbutos unedo, candellila wax, wool wax and leaf waxes of Pinus sp. has a melting point of 87-88^{o}F on a benzene plate, and 74-75^{o}F on the petroleum ether plate.

The mystery of 1-triacontanol as a powerful plant growth regulator was not known until in 1976, when Ries and co-workers (66) observed that coarsely chopped alfalfa hay (Medicago sativa L.) placed in bands below or to the side of crop seeds or plants at the rate of 190 to 470 kg/ha increased growth and yield of crops. That rate is equivalent to 5 to 12 kg/ha of nitrogen (66).

Following that potential increase in yield and growth of crops, in 1977, Ries and co-workers (61) isolated a crystalline substance from the soluble fraction of alfalfa hay (Medicago sativa L.) cv. "Pioneer 500". By means of mass spectrometry, the crystalline substance was identified as a primary alcohol with 30-carbon straight chain ($CH_3(CH_2)_{28}CH_2OH$) known as 1-triacontanol.

Triacontanol at 2.3 X 10^{-8}M increased the dry weight and leaf areas of rice seedlings (Oryza sativa L.) grown in nutrient solution within 3 hours, both under low and high light intensities (66). Triacontanol also increased dry weight and protein content in the dark within 6 hours (66).

Triacontanol as low as 0.01 g per liter promoted the growth of tobacco callus (Nicotiana tobaccum L.) (64). Triacontanol increased

the dry weight of rice seedlings in the presence of exogenous carbon dioxide (65). Treatment with both triacontanol and exogenous carbon dioxide increased ash, total reduced N, and soluble carbohydrates in the roots but not in the shoots of rice seedlings (65).

Ries et al (63) reported that the primary hydroxyl group of triacontanol was somehow active, and the chain length was specific in triggering the growth and plant development. The analogous compounds such as triacontanoic acid ($CH_3(CH_2)_{28}COOH$), 1-docosanol (C_{22}), 1-hexacosanol (C_{26}), 1-nonacosanol (C_{29}) and 1-heptacosanol (C_{27}) were not effective, and in some cases inhibited the growth of crops grown in nutrient culture when the compounds were applied at equimolar concentration.

The presence of three hydroxyl groups in brassinolide compound isolated from rape pollen (Brassica napus L.) was necessary to promote growth and to have activity as plant hormones (43).

Vlitos (81) isolated fatty alcohols from apical tissues of two month old Maryland Mammoth tobacco (Nicotiana tobaccum L.). These fatty alcohols when dissolved in ethanol and benzene significantly increased pea stem (Pisum sativum L.) elongation within 24 hours. The exact length of fatty alcohols was not known at that time.

An active compound in the cotyledon of lettuce seedlings proved to be necessary in promoting gibberellic acid to induce hypocotyl elongation (26). The active compound was isolated and identified as dihydroconiferyl alcohol (DCA) (70). Later it was found that dihydroconiferyl alcohol was a synergist of gibberallic acid and indole acetic acid inducing hypocotyl elongation of cucumber and lettuce (69).

The activity of triacontanol as a plant growth regulator was tested on many crop species, both in the field and in the greenhouse. The formulation is difficult since triacontanol does not dissolve in water and is only sparingly soluble in benzene and ethanol (31, 43, 62).

Tween 20 (polyoxyethylene sorbitan monolaurate), a detergent which is commonly used to dissolve triacontanol has no detrimental effect on plant growth (62). Tween 20 has been shown to enhance the uptake of gibberellic acid (25). Naturally occuring long chain alcohols of fatty acids have been demonstrated to exhibit some surfactant properties (25).

The compounds such as Tween 20, Tween 80, methyllinoleate, methyloleate, oil, natural fat, and lipids at concentrations between 1 to 6 μM caused additional growth of pea hypocotyl (Pisum sativum L.) when added to the basal medium containing 1.8 μM auxin and 0.3 μM GA_3 (75, 76). Stowe and Dotts (77) further reported that the pea stem elongation was enhanced by six other classes of alkane derivatives provided that the molecular length exceeded 20 A^o. These alkane derivatives were alkyl chlorides, bromides, iodides, sulfides, alkylbenzene and dialkylethers (77).

Bourgeois (3) noted that triacontanol between 0.01 and 4 ppm in dichloromethane decreased the germination of four okra species (Abelmoschus esculentus L.). However, Ries (62) reported that the dry weight of carrot, cucumber, barley and tomatoes grown in the greenhouse siginificantly increased when seeds of these crops were soaked in dichloromethane (DCM) containing 0.1 mg/liter of triacontanol for one hour. Dichloromethane enhanced the uptake of chemicals by dry

seeds in the absence of water (46).

The percent germination of lettuce, sicklepod and cotton seed was inhibited by more than 13 percent when the seeds of these crops were soaked in 0.3 percent dimethylsufoxide containing 10^{-5}M triacontanol (22).

The chloroform extract of chopped alfalfa (Medicago sativa L.) in phosphate buffer both at pH 4.0, and 9.0 when applied to the soil significantly increased the dry weight and water uptake of the 26 day old plants grown in a growth chamber (61).

Bowkamp et al (4) reported that foliar treatment of triacontanol on sweet potato (Ipomoea batatas L.) at 100 ppb significantly increased the total N in the leaf 5 days after treatment. The treatment did not increase total N, polyphenol oxidase, specific gravity or dry matter content in the roots.

The activity of triacontanol was reported to be very sensitive to metal ions, especially the salt of calcium and lanthanum (43). When the salt of either calcium or lanthanum was added to a new formulation of triacontanol the fresh weight of sweet corn was increased by over 50 percent. The percent increase in fresh weights of sweet corn was due to 6-19 percent increase in earlength and a 20 percent increase in the number of ears per plant. In another test with tomatoes and beans, the yield was increased by 70 percent and 90 percent respectively (43).

Triacontanol has been reportedly found in beeswax (Apis mellifica), lucern wax (Medicago sativa L.) and candellila wax (Euphorbia antisyphilitica L.) (38, 68). Chibnall et al (8) reported that triacontanol constitutes between 20-40 percent of the wax in the lac insect (Coccus

lacca), 40 percent in beeswax, 30 percent in candelilla wax, 40 percent in american cotton wax, 50 percent in wild white clover, 40 percent in Raphia ruffia, 40 percent in cactus, a trace amount in apple cuticle wax, and was not present in plants of the brassica family. Chromatographic analysis of beeswax (9) has revealed 31.6 percent of triacontanol from unsaponifiable fraction of the total alcohols.

Kolker (38) has employed Soxhlet extraction to determine the amount of triacontanol present in various plant species. He found that triacontanol amounted to 173 μg/g in alfalfa leaves, 481 μg/g in rice leaves, 234 μg/g in beeswax, 97 μg/g in cow manure, 36 μg/g in calf manure, 41 μg/g in rice roots and 234 μg/g in corn leaf. He also reported that triacontanol also can be found in the tissue of apple fruit parenchyma 0.3 μg/g, potato parenchyma 1.15 μg/g and potato periderm 0.68 μg/g.

Miwa (47) has shown no evidence of the presence of triacontanol in jojoba oil grown mostly in California and Arizona deserts. However, Kolker (38) has reported that jojoba oil contains 54 μg triacontanol per gram of oil.

Meinschein et al (45) reported that in the analysis of soil samples obtained from Sumatra, they found that the composition of alkenes ranged from C_{15} to C_{33}, and resembled the alkanes found in the beeswax. There is also evidence of normal and branched alkanes ranging from C_{16} to C_{35} found in the chloroplast of Antirrhinum majus L. (19).

Kranz et al (39) demonstrated that by the use of gas chromatographic analysis, the wax of sugar cane (Saccharum officinarum L.)

contains 3.5 percent triacontanol. Silicic acid column chromatography of chloroform extract from normal to "soft" Saurkraut has been shown to contain 3 percent of a C_{30} alkane (21).

From a study with (^{14}C) stearyl-alcohol, Kolattukudy (32) has pointed out that fatty alcohols were the limiting factors for the synthesis of waxy esters. The synthesis of waxy esters was neither stimulated by ATP, coenzyme A, palmityl-CoA, nor palmitic acid. However, the formation of waxy esters increased by increasing fatty alcohol concentration (32).

Eglinton et al (10) stated that in most cases 60 percent of the leaf waxes was n-nonacosane (C_{29}). After further 1-^{14}C) acetate study, they suggested that C_{30} compounds could be intermediate products, after elongation and decarboxylation, in the formation of n-nonacosane (10).

The compound C_{30} hydrocarbon has been traced down as a possible petroleum precursor. Martin et al (42) reported a C_{30} hydrocarbon has been found in crude extract of Stateline and Vinta Basin with 0.45 and 0.75 percent alkane present.

The young seedlings of pea and spinach have been reported to contain 78 percent and 90 percent n-hentriacontane (C_{31}) respectively (33). Kolattukudy (33) proved that head to head condensation of two molecules of palmitic acid followed by subsequent decarboxylation in the formation of n-hentriacontane is unlikely to occur. The biosynthesis of n-hentriacontane would rather follow the elongation and decarboxylation steps from the pre-existing fatty acids (30, 31, 33).

Keneda (27) demonstrated that the incorporation of (1-^{14}C) acetate

in the surface of plant waxes was not affected by light. However, the incorporation of (1-^{14}C) acetate into lipids was influenced by light energy. Harwood et al (20) also used (1-^{14}C) acetate in the study of the germination of pea seeds and concluded that the first two fatty acids synthesized were palmitic and stearic followed shortly by the long chain fatty acids of C_{20} to C_{26}. The long chain fatty acids and alcohols were found in the waxy component of the leaves (20).

Labeled amino acids of leucine have been incorporated into iso-fatty acids and paraffin of chain lengths from C_{16} to C_{26} and C_{29} to C_{33} of young tobacco leaves (34).

The young expanding leaves of Brassica oleracea L. synthesized paraffin most rapidly (34). Brassica oleracea L. var capitata has a predominant amount of n-nonacosane and di-n-tetradecylketone ($C_{14}H_{29}.CO.C_{14}H_{29}$) in its leaves (6).

Kolattukudy in a study using (1-^{14}C) acetate with detached leaves of the brassica family proved that n-nonacosane (C_{29}) was predominant. He further observed that the synthesis of plant waxes in some plants was inhibited by trichloroacetate which is used as a selective weed killer (30).

The treatment of slices of young pea leaves (Pisum sativum L.) with micro molar solution of α-chlorollyldiethyl dithiocarbamate, dichloroallyldiisoprophylthiocarbamate, or s-ethyldiprophylthiocarbamate resulted in inhibition of incorporation of (1-^{14}C) acetate into C_{31} alkane and C_{31} secondary alcohols (37). The epicuticular lipids and alcohols of pea (Pisum sativum L.) were reduced by more than 50 percent, when 10 M of diallate and N-(3-chlorophenyl)-isoprophyl-

carbamate applied to the roots or leaves (74). These results suggested that both carbamates and thiocarbamate pesticides interfere with biosynthesis of cuticular lipids and alcohols of plant waxes (37, 74).

Flore et al (13, 14) also reported that epicuticular wax biosynthesis of Brassica oleracea L. was inhibited by s-ethyldiprophylthiocarbamate (EPTC) and trichloroacetic acid (TCA) applied to the soil or foliage spray at the rate of 2.24 kg/ha. The thickness of the wax was not affected but the reduction in surface fine structure was observed.

Labeled C_2 to C_{18} acids were incorporated into fatty alcohols of C_{12} to C_{32}. There is no evidence as yet that the waxes secreted to the surface of the leaves are reabsorbed and utilized by the cells (36).

The metabolism and degredation of triacontanol or equivalent compounds were studied in order to know the persistence of the compounds in the soil (23, 24, 35, 54).

Kolattukudy and Hankin (35) have shown that ursulic acid ($C_{30}H_{48}O_3$), a major component of applex was, can be degraded by Pseudomonas sp., a gram negative rod, when ursulic acid is used as a sole carbon source.

Hopkin and Chibnall (23) found that Aspergillus versicolor had little growth on triacontanol isolated from carnauba wax, but had no growth when triacontanol was used as the sole carbon source in the culture medium. Triacontanol (C_{30}), n-nonacosane (C_{29}), n-hentriacontane, and n-tritriacontane (C_{33}) found in cow manure were derived mainly from the pasture plants (38, 54). It is unlikely that these high molecular weight hydrocarbons can be degraded by microorganisms

found in animal digestive tracts (38, 54).

Micrococcus cerificans (12) has been shown to be able to produce wax when grown on n-alkanes of more than 12 carbon chain. The highest production of waxes was observed when Micrococcus cerificans was grown on n-hexadecane and n-octadecane as a sole carbon source (12).

An ester, a common product of paraffin degradation, was not detected when Micrococcus cerificans was grown on n-nonacoasane as a sole carbon source (29).

In most cases, with the exception of a few species, the total wax content of a plant increased with the plant age. However, the wax melting point did not change markedly with maturity (40). Therefore many workers have investigated the hydrocarbon composition of plant waxes as a tool for taxonomic classification of plant species (11, 80).

Eglinton et al (11) investigated the plant waxes in the Sempervivoideae (Crassulaceae) family, and found no alkanes with carbon numbers less than C_{25} nor greater than C_{35}.

In β-diketone producing plants the relative amounts of β-diketone and alcohol vary with the stage of plant growth (79, 80). There was an inverse relationship between β-diketone and alcohol content in the wax composition of these plants. Results of a study with triticum species indicated at the earlier stage of growth (44 days after planting) alcohol content was high and β-diketone was low, whereas 66 days after planting, the amount of β-diketone was high (80).

Glaucan lines of wheat were characterized by the presence of β-diketone in the plant wax, and the green lines were characterized by the absence of a wax producing gene for β-diketone (1). Eucalyptus

waxes contain a major component of β-diketone in the plant waxes (24).

The component of waxes in sultana grape have been identified as soft wax (petroleum soluble) and hard wax (chloroform soluble) (59,60). Soft wax, which contains long carbon chains of alcohols, aldehydes, and esters plays a major role in prevention of water loss by transpiration. Hard wax, mostly oleanolic acid, constitutes about 70 percent of the total epicuticular wax but does not function in preventing water loss by transpiration (17). The waxy surface not only prevents the loss of water but also has been shown to act as a physical barrier or may contain chemicals that limit the growth of pathogens in initial stages of infection (41).

The effects of other growth regulators and chemicals on the growth and development of peppers (Capsicum annuum L.) have been studied (15, 48, 49, 50, 51, 55).

Nagdy et al (48) reported that 1,000 ppm of chloromequat (CCC) at 3 sprays with 15 day intervals after planting increased early yield and total yield of Capsicum annuum L. var. California Wonder by over 100 percent for both summer and winter plantings. They further stated that the immersion of plant roots for one hour in 1,000 ppm and 2,000 ppm of (CCC) decreased plant height, but increased the number of leaves, branches, and dry weight of the vegetative parts of the plants (49).

Fouad et al observed that when the roots of 50 days old California Wonder plants immersed in 2,000 ppm of (CCC) for one hour before planting, and then followed by subsequent spraying with the same compound at 10, 25, and 40 days after planting gave thicker and lignified epidermal cells which might provide frost resistance to the plants (15).

Immersion of roots of California Wonder plants before transplanting in 300, 400, and 500 ppm of ethrel (ethephon) decreased plant height, but increased the number of leaves, branches, dry weight of leaves, and increased fruit set and quality (50, 51).

Sprays of ethrel (ethephon) with 250 ppm and MH-30 at 3,000 ppm at first bloom gave the heaviest fruits with Capsicum annuum L. var. Saemual Kim Janggo Chu II, and the highest number of fruits with var. Cu Dae Kak (28).

Warade and Singh (82) have reported that 200 ppm planofix (which contains 4.5 percent NAA) applied at first bloom on Capsicum annuum L. significantly increased fruit set, fruit-volume, and yield per plant.

The seeds of Capsicum annuum L. var. California Wonder when invigorated in 240 mg/liter of Polyethylene Glycol-6,000 for 5 days at $15^{o}C$ significantly increased the yield in a field experiment (83). Gamma radiation has been reported to increase the early and total yield of Lycopersicon esculentum L. var. Revernum F_1 by 20 to 54 percent when the seeds were exposed to gamma rays before transplanting (16). Since the total cost for the production of peppers in the United States is expensive, any effort to increase the yield per acre or to decrease the cost of production is very useful (44, 56, 71).

MATERIALS AND METHOD

The study consisted of a preliminary test in the greenhouse in the fall of 1978, and two field tests conducted in the summer of 1979 and 1980 at Louisiana State University Hill Farm in Baton Rouge, Louisiana.

A new stock solution of triacontanol was made by dissolving 10 mg of triacontanol (1-hydrocytriacontane), a C-30 primary alcohol ($CH_3(CH_2)_{28}CH_2OH$) in 2 ml of oleic acid heated to 72^oC. Eight milliliter (ml) of triton X (Alkyl phenoxy polyethoxy ethanol) a detergent was dissolved in 490 ml of distilled water and stirred for 20 minutes with a magnetic stirrer. After 20 minutes the solution of triacontanol in 2 ml of oleic acid was poured into 498 ml of triton X solution and again stirred for another 20 minutes by a magnetic stirrer. The stock solution contained 10 mg of triacontanol per 500 ml of solution or equivalent to 20 mg of triacontanol per liter of solution. The series of dilutions were made no later than 48 hours after the stock solution was made.

Greenhouse Experiment (Fall 1978)

The purpose of this preliminary test was to determine:

a. The effectiveness of a new solution of triacontanol.

b. The concentrations at which, the best response to the crop species might be obtained.

Two crops, rice (Oryza sativa L.) var. Saturn and Tabasco pepper (Capsicum frutescens L.) were tested in this experiment. Since much previous work had been done on rice, it was used as a standard crop in this greenhouse work.

White plastic pots of the size 7cm x 7cm x 6cm were used. The soil medium consisted of an equal mixture of soil, peat and sand 1:1:1 by volume and 180 grams was needed to fill each pot. The design used in this experiment was a complete Randomized Block (C.R.D.).

Pepper plants (Capsicum frutescens L.)

Four seeds of Tabasco pepper were planted on August 17, 1978 in each pot. The pots were watered with distilled water at an equal rate when it was needed. Thinning was done on August 30 to have only one plant per pot and to have a possible equal size of plant in each pot. Three tablespoons of 8:8:8 fertilizer were dissolved in a gallon of water and 25 ml was applied per pot one day after thinning was done.

The treatments in the first test consisted of 15 ml per plant applied on September 5 and 10 ml per plant applied on October 10, 1978 of the materials and concentrations as shown below in T_1 through T_{11}.

T_1 = CHK (distilled water)

T_2 = Triton X + oleic acid

T_3 = Triton X

T_4 = Oleic acid

T_5 = 5mg triacontanol per liter of solution

T_6 = 2.5mg triacontanol per liter of solution

T_7 = 1.25 mg triacontanol per liter of solution

T_8 = 1.00 mg triacontanol per liter of solution

T_9 = 0.10 mg triacontanol per liter of solution

T_{10} = 0.01 mg triacontanol per liter of solution

T_{11} = 0.001 mg triacontanol per liter of solution

Data were taken on plant height, fresh weight, water content and dry matter on November 4, 1978. The plants were cut at the top level of the pots and immediately weighed.

The plants were put in a drying sac and placed in the oven for 96 hours at 68^{o}C. The water content of the plants was obtained by subtracting dry weight from the fresh weight.

Rice plants

The seeds of rice (Oryza sativa L.) var. Saturn were planted on August 25, 1978. The plants were watered with distilled water at an equal rate when it was needed. Thinning was done to leave only five tillers per pot one week before the first treatment was applied. Three tablespoons of 8:8:8 fertilizer were dissolved in a gallon of water and 25 ml was applied per pot one day after thinning was done.

The first treatment was given on September 5, 1978, and the second treatment on October 10, 1978. Rice was harvested on December 23, 1978. and the same parameters were measured as with peppers.

Field Experiment (Summer 1979)

The site for the field experiment was chosen on an Olivier Silt

Loam Soil at Louisiana State University Hill Farm in Baton Rouge, Louisiana. The purpose of this study was to determine the effectiveness of a new solution of triacontanol on the growth and development of Tabasco pepper (Capsicum frutescens L.) under field condition after it was found to be effective in the greenhouse. Seeds of Tabasco pepper were planted in peat pots containing jiffy mix media in the greenhouse before transplanting into the field. The soil of the site of experiment was analyzed by the Louisiana State University Soil Testing Laboratory. The results of the determinations from the top soil (0 - 6") appear as below:

Extractable Phosphorus	311 ppm
Extractable Potassium	110 ppm
Extractable Calcium	596 ppm
Extractable Magnesium	54 ppm
Soil Reaction (pH)	5.5
Organic matter %	0.96

The soil tests indicated that the soil was high in extractable phosphorus, medium in extractable potassium, medium in extractable calcium and low in extractable megnesium. pH of 5.5 is within the optimum pH range (5.5 to 7.0) for pepper (44).

The design used was a Latin Square (L.S.D.) with 7 treatments and 7 replications with four plants in each treatment. The plants were spaced 3 ft apart within the row, 4 ft between the rows and 4 ft alleyways.

The treatment consisted of:

T_1 = CHK (distilled water)

T_2 = 2.5 mg triacontanol per liter of solution

T_3 = 1.25 mg triacontanol per liter of solution

T_4 = 1.00 mg triacontanol per liter of solution

T_5 = 0.1 mg triacontanol per liter of solution

T_6 = 0.01 mg triacontanol per liter of solution

T_7 = Fish wash

Transplanting was done on May 23, 1979. All the treatments except treatment number 7 were applied with 25 ml of solution at the time of tranplanting. In treatment number 7 (T_7), 454 grams of Mackeral fish head soaked and washed in 2 liters of distilled water for 15 minutes and 50 mls of this solution were applied during transplanting in the field. The nutrient analysis of the fish wash was done by Louisiana State University Soil Testing Laboratory. The results of the test are listed as below:

Extractable P = 84 ppm

Extractable K = 162 ppm

Extractable Ca= 2 ppm

Extractable Mg= 6 ppm

(pH) = 8.1

Zn = 0.14 ppm

Mn = 0.05 ppm

Cu = 0.12 ppm

Fe = 0.80 ppm

The height and width of plants were taken on July 4, 1979, at the time of first bloom. The width of the plants was measured as an average

of two dimensional length right angle to each other on the top of the plants. The first harvest was made on August 29, 1979. The fruits were harvested at the red-ripe stage minus the pedicels. The data for the first harvest was used to evaluate the early maturity of the plants. The second harvest was on September 14, 1979, and the third was on November 6, 1979. The weight of the fruits (fresh weight) was taken immediately after each harvest. For the dry weight, 80 grams of fresh fruits from the first harvest and 200 grams each in the second and third harvest were dried in the oven for 96 hours at 72°C. The number of fruits were counted in each harvest except in the third harvest because there were too many fruits to be counted. Between 2o and 25 grams of matured but not yet fully expanded fresh leaves were harvested 3 days after the first harvest and were washed with tap water and rinsed several times with distilled water. The leaves were dried in a forced air oven at 68°C for 72 hours. The data were analyzed according to Duncan's New Multiple Range Test (72).

Field Experiment (Summer 1980)

In this experiment some modifications were made, but the site and design of experiment were maintained. In this experiment, triacontanol was applied twice at the rate of 25 mls per plant at the time of transplanting in the field and later at the first bloom. The fish wash was also applied twice at the rate of 50 mls per plant at the time of transplanting and later at the first bloom. The diameter and length of the fruits from the first harvest were measured.

Three weeks before the transplanting date, the soil and fish wash were analyzed by Louisiana State University Soil Testing Laboratory.

The results were as follows:

Top soil (0-6")

Extractable Phosphorus	=	311 ppm
Extractable Potassium	=	87 ppm
Extractable Calcium	=	686 ppm
Extractable Magnesium	=	63 ppm
Soil Reaction (pH)	=	5.5
Organic Matter %	=	0.72

Micro Nutrients extracted with EDTA:

Zn	=	5.48	
Cu	=	26.02	all are high
Mn	=	30.0	
Fe	=	65.4	

The soil test indicated that the soil was high in extractable phosphorus, medium in extractable potassium, medium in calcium and low in extractable magnesium. pH of 5.5 is within the optimum range (5.5 to 7.0) for pepper growing.

Fish wash

Extractable Phosphorus	=	61 ppm
Extractable Potassium	=	160 ppm
Extractable Calcium	=	3.4 ppm
Extractable Magnesium	=	7.4 ppm
pH	=	6.3

Zn	=	0.20 ppm	
Mn	=	0.04 ppm	all are low
Cu	=	0.13 ppm	
Fe	=	0.53 ppm	

The extractable Phosphorus, Calcium and Magnesium were low, but extractable Potassium was medium. Soil reaction pH 6.3 was also within the optimum range (5.5 to 7.0) for pepper growing (44).

The transplanting date was June 11, 1980. The first harvest was on September 26, 1980, the second and third harvests were on October 10, 1980 and November 18, 1980 respectively.

All the data obtained were similar as in the summer of 1979 crops, except that the leaf samples were analyzed by Louisiana State University Soil Testing Laboratory after they were dried in a forced air oven for 72 hours at $68^{o}C$. All the data were analyzed using Duncan's New Multiple Range Test (72).

EXPERIMENTAL RESULTS AND DISCUSSION

Greenhouse Experiment (Fall 1978)

Tabasco pepper (Capsicum frutescens L.)

A test was conducted to determine the effect of various concentrations of triacontanol on the growth, fresh weight, dry weight and water content. The effect of triacontanol on the growth of Tabasco pepper are shown in table 1. Triacontanol at 0.01 and 0.1 mg per liter applied at the rate of 15 ml and 10 ml of solution per plant 18 and 43 days after planting significantly increased the growth of Tabasco pepper grown in the greenhouse. The inhibitory effect of triacontanol on the growth of Tabasco pepper was observed in this table when 5.00 mg per liter of triacontanol was applied at the same rate as above. The mixture of oleic acid and triton X did not inhibit the growth of Tabasco pepper. However, oleic acid and triton X also applied twice at the rate of 15 and 10 ml 18 and 43 days after planting separately inhibited the growth of Tabasco pepper. Poidevin (57) reported that Aliphatic acids of C_2 to C_9 inhibited the germination of mustard (Brassica juncea L.) The inhibitory effects of aliphatic acids decreased with increasing carbon chains (78). Tween 20, a detergent, has been reported by Ries (62) to have no detrimental effect on plant growth. This is not true with triton X (a detergent) which inhibited the growth of Tabasco pepper as shown in table 1.

The inhibitory effects of oleic acid, triton X and triacontanol at 5.00 mg per liter were also observed on fresh weight (Table 2), dry weight (Table 3) and water content (Table 4). As reported in table

Table 1.

The effect of various concentrations of triacontanol* on the growth of Tabasco pepper (Capsicum frutescens L.) in the greenhouse in the fall of 1978.

Triacontanol (mg /liter)	Mean height mm/plant 71 days after planting
CHK (distilled water)	22.75 bdc
Oleic acid + Triton X **	21.75 edc
Triton X ***	17.67 e
Oleic acid ****	12.92 F
5.00	20.67 ed
2.50	23.75 bdc
1.25	26.92 ba
1.00	27.33 ba
0.10	28.83 a
0.01	29.92 a
0.001	26.08 bac

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 18 and 43 days after planting.

** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml at 18 and 43 days after planting.

*** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

****2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

Table 2.

The effect of various concentrations of triacontanol* of the fresh weight of tops of Tabasco pepper (Capsicum frutescens L.) grown in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean fresh weight gram/plant 71 days after planting
CHK (distilled water)	5.15 bac
Oleic acid + Triton x **	3.96 edc
Triton X ***	3.18 e
Oleic acid****	1.51 F
5.00	3.50 ed
2.50	4.50 bdc
1.25	4.90 bdc
1.00	5.62 ba
0.10	6.08 ba
0.01	6.68 a
0.001	5.32 bac

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 18 and 43 days after planting.

** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml at 18 and 43 days after planting.

*** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

**** 2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

Table 3.

The effect of various concentrations of triacontanol* on the dry weight** of tops of Tabasco pepper (Capsicum frutescens L.) grown in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean dry weight gram/plant (71 days after planting)
CHK (distilled water)	1.09 ba
Oleic acid + Triton X ***	0.73 dc
Triton X ****	0.64 d
Oleic acid *****	0.28 e
5.00	0.65 d
2.50	0.89 bdc
1.25	0.89 bdc
1.00	1.00 bac
0.10	1.07 ba
0.01	1.21 a
0.001	1.01 bac

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 18 and 43 days after planting.

** Mean dry weight of tops of Tabasco pepper dried in a forced air oven at 68°C for 72 hours in gram per plant.

*** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml at 18 and 43 days after planting.

**** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10m ml 18 and 43 days after planting.

*****2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

Table 4.

The effect of various concentrations of triacontanol* on the water content of Tabasco pepper (Capsicum frutescens L.) grown in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean water content gram/plant (71 days after planting)
CHK (distilled water)	4.07 bdc
Oleic acid + Triton x **	3.24 edc
Triton x ***	2.54 e
Oleic acid ****	1.24 F
5.00	2.85 ed
2.50	4.11 bdc
1.25	4.01 bdc
1.00	4.62 ba
0.10	5.01 ba
0.01	5.47 a
0.001	4.31 bac

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 18 and 43 days after planting.

** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml at 18 and 43 days after planting.

*** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

**** 2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 18 and 43 days after planting.

2 and 3, triacontanol did not significantly increase the fresh weight and dry weight of 71 day old Tabasco pepper grown in the greenhouse. These results are in agreement with Bowkamp (4), who reported that 100 ppb triacontanol did not increase the dry matter content of sweet potatoes grown in the field. However, 0.01 mg per liter of triacontanol significantly increased the water content of 71 day old Tabasco pepper as reported in table 4. This is in agreement with Ries (61), who reported that 0.01 and 0.1 mg per liter of triacontanol significantly increased water uptake of rice seedlings grown in the greenhouse. The mechanisms of the activity of triacontanol are not yet known, but the significant results obtained in growth and water uptake of Tabasco peppers suggest that triacontanol was somehow active in cell division and elongation. The increase in water uptake of the plants may provide a mechanism for drought resistance. This phenomenon could be important for Tabasco pepper to be grown in the south especially in Louisiana where the weather is extremely hot during the summer.

Rice (Oryza sativa L.)

The tests were conducted to determine the growth, fresh weight, dry weight and water content of rice (Oryza sativa L.) in the greenhouse. In table 5, triacontanol at 1.25 mg per liter applied twice at the rate of 15 ml and 10 ml 11 and 46 days after planting significantly increased the growth of 118 day old rice. The inhibitory effect of triacontanol on plant height of rice was also observed in this table when 5.00 mg per liter of triacontanol was applied at the same rate as above. The mixture of oleic acid and triton x did not inhibit the growth of rice. However, oleic acid and trition x separately inhibited

Table 5.

The effect of various concentrations of triacontanol* on the growth of rice (Oryza sativa L.) var. Saturn in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean plant height mm/plant 118 days after planting
CHK (distilled water)	61.3 bc
Oleic acid + Triton X **	62.2 bac
Triton x***	51.3 ed
Oleic acid ****	47.2 e
5.00	56.1 dc
2.50	68.1 ba
1.25	70.9 a
1.00	68.6 ba
0.10	66.2 ba
0.01	67.0 ba
0.001	68.9 ba

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant at 11 and 46 days after planting.

** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

*** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

**** 2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

the growth of rice. The inhibitory effect of triton x, oleic acid and triacontanol at 5.00 mg per liter were also observed on fresh weight in table 6, dry weight in table 7 and water content in table 8. Triacontanol did not significantly increase the fresh weight and water content as reported in table 6 and 8. This is in contrast with Ries (61) who reported that triacontanol at 0.01 and 0.1 mg per liter of triacontanol significantly increased the water uptake of rice grown in nutrient culture in the greenhouse. However, 0.001 mg per liter of triacontanol significantly increased the dry weight of 118 day old rice grown in the greenhouse. These results agree with Ries (61) who found that 0.01 and 0.1 mg per liter of triacontanol in nutrient culture significantly increased the dry weight of rice seedlings grown in the greenhouse.

These results suggest that triacontanol significantly increased the growth of both crops (Tabasco pepper and rice) grown in the greenhouse.

Field Experiment (Summer of 1979)

This test was conducted to determine the effects of various concentrations of triacontanol on the yield, early maturity, number of fruits, leaf and fruit dry weight, and the growth of Tabasco pepper (Capsicum frutescens L.) grown in the field.

Triacontanol at 1.25 mg per liter applied at the rate of 25 ml per plant at the time of transplanting in the field significantly increased the early maturity (yield I) of Tabasco pepper (table 9). Fish wash applied at the rate of 50 ml per plant at the time of transplanting significantly increased the early maturity (yield I) of Tabasco pepper as reported in table 9. In harvest II (yield II), all treat-

Table 6.

The effect of various concentrations of triacontanol* on the fresh weight of tops of rice (Oryza sativa L.) var. Saturn grown in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean fresh weight gram/plant 118 days after planting
CHK (distilled water)	4.13 bac
Oleic acid + Triton X**	4.15 bac
Triton x ***	1.24 d
Oleic acid****	0.90 d
5.00	3.01 c
2.50	4.82 ba
1.25	4.65 ba
1.00	4.45 ba
0.10	3.78 bc
0.01	4.10 bac
0.001	5.22 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 11 and 46 days after planting.

** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

*** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

**** 2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

Table 7.

The effect of various concentrations of triacontanol* on the dry weight** of tops of rice (Oryza sativa L.) var. Saturn grown in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean dry weight gram/plant 118 days after planting
CHK (distilled water)	1.10 bc
Oleic acid + Triton X***	1.01 bc
Triton X ****	0.27 d
Oleic acid *****	0.20 d
5.00	0.77 c
2.50	1.19 ba
1.25	1.29 ba
1.00	1.24 ba
0.10	1.01 bc
0.01	1.18 ba
0.001	1.48 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 11 and 46 days after planting.

** Mean dry weight of tops of rice dried in a forced air oven at 68°C for 72 hours in gram per plant.

*** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

**** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

*****2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

Table 8.

The effect of various concentrations of triacontanol* on the water content of rice (Oryza sativa L.) var. Saturn grown in the greenhouse in the fall of 1978.

Triacontanol (mg/liter)	Mean water content gram/plant 118 days after planting
CHK (distilled water)	3.04 ba
Oleic acid + Triton x **	3.14 ba
Triton x ***	1.17 c
Oleic acid ****	0.70 c
5.00	2.23 b
2.50	3.43 a
1.25	3.57 a
1.00	3.21 a
0.10	2.77 ba
0.01	2.92 ba
0.001	3.75 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 15 ml and 10 ml of solution per plant 11 and 46 days after planting.

** 2 ml of oleic acid and 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) were dissolved in 490 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

*** 8 ml of triton X (Alkyl phenoxy polyethoxy ethanol) was dissolved in 492 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

**** 2 ml of oleic acid was dissolved in 498 ml of distilled water and applied at the rate of 15 ml and 10 ml 11 and 46 days after planting.

Table 9.

The effect of various concentrations of triacontanol* and fish wash on early maturity and yield of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Yield I (grams) 8-29-79
CHK (distilled water)	77.50 c
2.50	87.32 bc
1.25	120.71 a
1.00	103.75 abc
0.10	99.29 abc
0.01	90.71 abc
Fish wash**	118.04 ba

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** 454 grams of mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

ments are significantly higher in yield than the check as found in table 10. Triacontanol at 1.25 mg per liter applied at the same rate as stated above gave the highest yield compared to all other treatments.

In harvest III (yield III) as reported in table 11, only triacontanol at 1.25 mg per liter gave a significantly higher yield compared to the check. All of these results are in contrast with Ries (66) who reported that neither seed nor soil treatments increased the yield of crops when treated with synthetic triacontanol. In the total yield of Tabasco pepper (harvest of I + II + III), all the treatments are significantly higher than the check as demonstrated in table 12. Triacontanol at 1.25 mg per liter give the highest yield compared to all other treatments. These results are in agreement with Ries (67) who reported that coarsely chopped alfalfa (Medicago sativa L.) applied to the soil increased the yield of many crops by 10 to 40 percent in field experiments. Fish wash and triacontanol at 1.25 mg per liter gave significantly higher number of fruits than the check in the first and second harvest as demonstrated in table 13 and 14. The total number of fruits was also significantlyincreased when Tabasco pepper was treated with fish wash and triacontanol at 1.00 and 1.25 mg per liter in the summer of 1979 (table 15). Triacontanol did not significantly increase the fruit dry weight (table 16), growth (table 17(, width (table 18) and leaf dry weight (table 19). Fish wash significantly increased the diameter of Tabasco pepper plants as reported in Table 18. As shown in tables 16, 17, and 19, fish wash did not have any significant effect on fruit dry weight, growth and leaft dry weight of Tabasco pepper. In this

Table 10.

The effect of various concentrations of triacontanol* and fish wash on the yield (harvest II) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Yield II (grams) 9-14-79
CHK	277.46 b
2.50	385.36 a
1.25	410.77 a
1.00	391.69 a
0.10	368.00 a
0.01	359.43 a
Fish wash **	389.69 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 11.

The effect of various concentrations of triacontanol* and fish wash on the yield (harvest III) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	yield III (grams) 11-6-79
CHK	399.54 b
2.50	495.42 ab
1.25	540.42 a
1.00	455.65 ab
0.10	492.39 ab
0.01	471.25 ab
Fish wash **	464.82 ab

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 12.

The effect of various concentrations of triacontanol* and fish wash on the total yield (harvest I + II + III) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Total Yield (grams)
CHK	754.50 b
2.50	968.09 a
1.25	1071.91 a
1.00	951.09 a
0.10	959.68 a
0.01	921.39 a
Fish wash **	972.55 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 13.

The effect of various concentrations of triacontanol* and fish wash on the number of fruits (harvest I) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Number of fruits 8-30-79
CHK	85.82 b
2.50	97.39 ab
1.25	128.42 a
1.00	111.07 ab
0.10	106.21 ab
0.01	96.43 ab
Fish wash **	123.36 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** 454 grams of Mackerel fish head was soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 14.

The effect of various concentrations of triacontanol* and fish wash on the number of fruits (harvest II) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Number of fruits 9-15-79
CHK	395.21 b
2.50	471.03 ab
1.25	536.29 a
1.00	482.35 ab
0.10	462.79 ab
0.01	472.21 ab
Fish wash**	485.81 b

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 15.

The effect of various concentrations of triacontanol* and fish wash on the total number of fruits (harvest I + II) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Total number of fruits
CHK	481.04 b
2.50	568.42ab
1.25	664.71 a
1.00	593.42 a
0.10	569.00 ab
0.01	568.64 ab
Fish wash**	609.17 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** 454 grams of Mackerel fish head were soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 16.

The effect of various concentrations of triacontanol* and fish wash on the percent dry weight** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Mean per cent fruit dry weight		
	8-29-79	9-14-79	11-6-79
CHK	25.38	29.86	36.83
2.50	25.32	29.20	37.97
1.25	25.83	29.90	36.70
1.00	26.31	29.49	37.52
0.10	25.47	29.36	37.25
0.01	24.97	28.90	37.57
Fish wash ***	25.03	29.79	37.83
	N.S.	N.S	N.S

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** 80 grams of fresh fruits for the first harvest and 200 grams each in the second and third harvest were dried in the oven for 96 hours at 72^oC.

*** 454 grams of Mackerel fish head was soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 17.

The effect of various concentrations of triacontanol* and fish wash on the growth ** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Mean plant height (mm)
CHK	55.01 bac
2.50	52.63 c
1.25	57.60 ba
1.00	55.06 bac
0.10	54.07 bac
0.01	52.84 bc
Fish wash ***	58.81 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** The growth was taken on 7-4-1979 this was at first bloom.

*** 454 grams of Mackerel fish head was soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 18.

The effect of various concentrations of triacontanol* and fish wash on the width** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Mean diameter (mm)
CHK	38.57 bc
2.50	34.59 c
1.25	40.99 ba
1.00	37.41 bc
0.10	38.76 bc
0.01	38.54 bc
Fish wash***	44.60 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** The width was taken on 7-4-1979 as an average of two dimensional directions right angle to each other measured from the top of the plants; this is at first bloom.

*** 454 grams of Mackerel fish head was soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

Table 19.

The effect of various concentrations of triacontanol* and fish wash on the percent leaf dry weight** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1979.

Triacontanol (mg/liter)	Mean percent leaf dry weight
CHK	21.20
2.50	21.06
1.25	21.83
1.00	21.69
0.10	20.63
0.01	21.07
Fish wash***	21.09
	N.S.

* 1-hydroxytriacontane $(CH_3CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field.

** Between 20 to 25 grams of matured but not yet fully expanded fresh leaves were harvested 3 days after the first harvest and were dried in a forced air oven for 72 hours at $68^{o}C$.

*** 454 grams of Mackerel fish head was soaked and washed in 2 liters of distilled water for 15 minutes and 50 ml of this solution was applied at the time of transplanting in the field.

field experiment, triacontanol at 1.25 mg per liter and fish wash significantly increased the early maturity, total yield and total number of fruits of Tabasco pepper grown in the field in the summer of 1979.

Field Experiment (Summer 1980)

The tests were conducted to determine the effect of various concentrations of triacontanol on the growth, yield, early maturity, number of fruits, fruit size, fruit and leaf dry weight and nutrient content of the leaves of Tabasco pepper.

Triacontanol at 1.25 mg per liter applied twice at the rate of 25 ml per plant at the time of transplanting in the field and later at first bloom significantly increased the early maturity (yield I) of Tabasco pepper as reported in table 20. In the same table, fish wash applied twice at the rate of 50 ml per plant at the time of transplanting and later at first bloom significantly increased the early maturity (yield I) of Tabasco pepper. Triacontanol at 0.01, 0.10, 1.00 and 1.25 mg per liter and fish wash applied at the same rate as above significantly increased the yield II (harvest II) of the same crop as shown in Table 21. Yield III (harvest III) and total yield of all treatments (harvest I + II + III) as reported in tables 22 and 23, are significantly higher than the check except that triacontanol at 2.5 mg per liter did not significantly increase the third harvest and total yield of Tabasco pepper. However, triacontanol at 1.25 mg per liter gave the highest yield compared to all other treatments.

Triacontanol and fish wash did not significantly increase the dry weight of fruit and leaf of Tabasco pepper as reported in table 24 and

Table 20.

The effect of various concentrations of triacontanol* and fish wash on early maturity and yield of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Yield I (grams) 9-26-80
CHK	100.03 c
2.50	102.80 c
1.25	160.70 ab
1.00	134.47 abc
0.10	128.81 bc
0.01	131.57 abc
Fish wash**	170.00 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 21.

The effect of various concentrations of triacontanol* and fish wash on the yield (harvest II) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg.liter)	Yield II (grams) 10-10-80
CHK	142.79 c
2.50	171.53 bc
1.25	245.06 a
1.00	202.23 ab
0.10	236.61 a
0.01	222.29 a
Fish wash**	240.89 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 22.

The effect of various concentrations of triacontanol* and fish wash on the yield (harvest III) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Yield III (grams) 11-18-80
CHK	154.84 b
2.50	176.87 b
1.25	264.76 a
1.00	226.44 a
0.10	238.34 a
0.01	232.30 a
Fish wash**	235.87 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 23.

The effect of various concentrations of triacontanol* and fish wash on the total yield (harvests I + II + III) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Total yield (grams)
CHK	397.66 c
2.50	451.20 c
1.25	670.51 a
1.00	563.14 b
0.10	603.77 ab
0.01	586.16 ab
Fish wash **	646.76 ab

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 24.

The effect of various concentrations of triacontanol* and fish wash on the percent fruit dry weight** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol	Mean percent dry weight		
	9-30-80	10-14-80	11-22-80
CHK	28.10	30.07	37.37
2.50	27.81	31.07	37.31
1.25	27.47	29.76	38.63
1.00	27.50	28.71	36.06
0.10	26.90	29.46	37.14
0.01	27.40	31.26	38.54
Fish wash***	26.33	29.97	38.64
	N.S	N.S	N.S

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2)H$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at first bloom.

** 80 grams of fresh fruits for the first and 200 grams each in the second and third harvests were dried in the oven for 96 hours at $72^{o}C$.

*** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

30. Fish wash and triacontanol at 1.25 mg per liter applied twice at the rate of 25 ml per plant at the time of transplanting and later at first bloom significantly increased the number of fruits (harvest I) as shown in Table 25 and the number of fruits (harvest II) in Table 26.

Triacontanol at 0.01, 0.10, 1.00 and 1.25 mg per liter and fish wash significantly increased the total number of fruits of Tabasco pepper (Table 27). Triacontanol at 1.25 mg per liter and fish wash significantly increased the growth of Tabasco pepper as found in Tables 28 and 29. Triacontanol and fish wash did not increase the length and diameter of Tabasco pepper as reported in table 31. The effect of triacontanol and fish wash on the nutrient content of the leaves of Tabasco pepper is reported in table 32. Triacontanol did not increase the percent N, P, K, Ca, Zn and Cu in the leaves of Tabasco pepper. However, triacontanol at 1.00 and 1.25 mg per liter significantly lowered the amount of magnesium in the leaves of Tabasco pepper compared to the control. This result may explain the activity of metal ions, as reported by Maugh (43) who stated that the activity of triacontanol was enhanced by the salt of calcium or lanthanum. Magnesium could be one of the activator cations that may be needed by triacontanol in other parts of the plant organs. The lesser amount of magnesium in the leaves could be the result of relocations of magnesium in other parts of plant tissues. Triacontanol at 0.10 mg per liter significantly lowered the amount of iron (Fe) found in the leaves of Tabasco pepper. The real mechanism for this phenomenon was not known, but the explanation given for magnesium may also be applied here.

Table 25.

The effect of various concentrations of triacontanol* and fish wash on the number of fruits (harvest I) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean number of fruits (harvest I)
CHK	120.58 b
2.50	132.57 b
1.25	186.99 a
1.00	161.46 ba
0.10	143.39 b
0.01	158.17 ba
Fish weight**	187.04 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 26.

The effect of various concentrations of triacontanol* and fish wash on the number of fruits (harvest II) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean number of fruits (harvest II)
CHK	172.31 c
2.50	223.03 bc
1.25	273.57 ba
1.00	263.10 ba
0.10	303.56 a
0.01	288.23 a
Fish wash**	315.53 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 27.

The effect of various concentrations of triacontanol* and fish wash on the total number of fruits (harvests I + II) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean total number of fruits (harvests I + II)
CHK	292.90 c
2.50	355.60 bc
1.25	460.56 a
1.00	424.56 ab
0.10	446.94 a
0.01	446.40 a
Fish wash **	502.57 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test. $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at first bloom.

** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 28.

The effect of various concentrations of triacontanol* and fish wash on the growth ** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean height (mm)
CHK	53.59 b
2.50	52.83 b
1.25	60.97 a
1.00	55.24 b
0.10	52.96 b
0.01	54.73 b
Fish wash***	60.03 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** The growth was taken on 8-15-1980, this is two weeks after the second application of triacontanol.

*** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 29.

The effect of various concentrations of triacontanol* and fish wash on the diameter** of Tabasco pepper (Capsicum frutescens L.) plants in the summer of 1980.

Triacontanol (mg/liter)	Mean diameter (mm)
CHK	39.36 b
2.50	37.00 b
1.25	43.78 a
1.00	39.46 b
0.10	38.50 b
0.01	39.54 b
Fish wash ***	45.11 a

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** The diameter was taken on 8-15-1980 as an average of two dimensional directions right angle to each other measured from the top of the plants.

*** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 30.

The effect of various concentrations of triacontanol* and fish wash on the percent leaf dry weight** of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean percent leaf dry weight
CHK	31.01
2.50	30.66
1.25	31.07
1.00	31.43
0.10	31.24
0.01	32.04
Fish wash***	32.33
	N.S.

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** Between 20 and 25 grams of matured but not yet fully expanded fresh leaves were harvested on 9-9-1980 (3 days after the first harvest) and were dried in a forced air oven for 72 hours at 68°C.

*** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 31.

The effect of various concentrations of triacontanol* and fish wash on the fruit size** (from harvest I) of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean length of fruits (mm)	Mean diameter of fruits (mm)
CHK	30.73 ba	9.43
2.50	30.50 ba	9.47
1.25	30.00 ba	9.07
1.00	29.50 b	9.11
0.10	30.41 ba	9.34
0.01	30.61 ba	9.16
Fish wash**	31.24 a	9.10
		N.S

Any means not followed by the same letter are significantly different according to Duncan's New Multiple Range Test $P < .05$

* 1-hydroxytriacontane ($CH_3(CH_2)_{28}CH_2OH$), an alcohol applied at the rate of 25 ml per plant at the time of transplanting in the field and later at the first bloom.

** The length and diameter of fruits were taken as an average of 50 fruits.

*** 454 grams of Mackerel fish head soaked and washed in 2 liters of distilled water for 15 minutes and this solution was applied at the rate of 50 ml per plant during transplanting in the field and another 50 ml per plant at first bloom.

Table 32.

The effect of various concentrations of triacontanol and fish wash on the mineral nutrient content of the leaves of Tabasco pepper (Capsicum frutescens L.) in the summer of 1980.

Triacontanol (mg/liter)	Mean percent mineral nutrient contents in the leaves							
	N	P	K	Ca	Mg	Zn	Cu	Fe
CHK	6.70	0.52	3.10	0.64	0.19 a	45.43	26.14	121.71 a
2.50	6.64	0.53	3.17	0.57	0.18 ba	42.00	24.00	122.14 a
1.25	6.71	0.53	3.02	0.63	0.17 b	47.43	24.71	115.57 ba
1.00	6.60	0.53	3.02	0.59	0.17 b	40.86	25.71	113.86 ba
0.10	6.69	0.52	2.98	0.62	0.18 ba	41.86	26.14	105.29 b
0.01	6.52	0.50	3.10	0.62	0.18 ba	47.71	27.86	112.86 ba
Fish wash	6.58	0.51	2.89	0.65	0.18 ba	38.29	23.14	109.57 b
	N.S	N.S	N.S	N.S		N.S	N.S	

The results of these two field tests for both Summer of 1979 and 1980 are consistent. Triacontanol at 1.25 mg per liter and fish wash gave the best result on the total yield and the total number of fruits of Tabasco pepper. In the summer of 1980, triacontanol at 1.25 mg per liter and fish wash significantly increased the growth of Tabasco pepper. The positive effects of fish wash in triggering the growth of Tabasco pepper may result from the various nutrients, especially moderate level of Potassium, found in the fish wash. The difference between total yield in 1979 and 1980 crops are due to the length of time between harvests.

SUMMARY

In the fall of 1978, Tabasco pepper (Capsicum frutescens L.) and rice (Oryza sativa L.) were subjected to various concnetrations of triacontanol in the greenhouse. Triacontanol at 0.01 and 0.1 mg per liter applied twice at the rate of 15 ml and 10 ml 18 and 43 days after planting significantly increased the plant growth and water content of 71 day old Tabasco peppers. The solution of oleic acid and triton x (Alkyl phenoxy polyethoxy ethanol) did not inhibit the plant height, fresh weight, dry weight and water content of Tabasco pepper and rice. However, oleic acid and triton x separately inhibited the growth, fresh weight, dry weight and water content of both crops tested. In the field test, in the summer of 1979 and 1980, fish wash applied at the rate of 50 ml per plant at the time of transplanting or another 50 ml added later at first bloom significantly increased early maturity, total yield and total number of fruits of Tabasco pepper. Triacontanol at the rate of 1.25 mg per liter applied at the rate of 25 ml at the time of transplanting or another 25 ml added later at first bloom significantly increased the early maturity, total yield and total number of fruits of Tabasco pepper. The effective concentration of triacontanol in the greenhouse is much less than in the field. Triacontanol at 1.25 mg per liter applied at the rate as stated above increased the yield of Tabasco pepper by 42 percent in 1979 and 68 percent in 1980. In conclusion, the new formulation of triacontanol was effective on the growth and deve-

lopment of Tabasco pepper both in the greenhouse and field. Triacontanol at 1.25 mg per liter applied at the rates as discussed above could be recommended as a method of increasing the production of Tabasco pepper.

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VITA

Awang Soh Mamat was born at Kampung Periok, Kelantan, West Malaysia, on July 24, 1948. He received his elementary and part of his secondary education in Kelantan. He graduated from Alam Shah School, Kuala Lumpur, in 1969. Upon completion of his secondary education, he worked as a temporary teacher at Maahad Muhammadi, Kelantan. In 1971, he joined the College of Agriculture, Malaysia, and graduated with Diploma in Agriculture three years later. Then, he was employed by the Malaysian Agriculture Research and Development Institute (MARDI) as a Research Assistant.

In August 1975, he came to the United States under the sponsorship of MARDI to study at the Louisiana State University until December, 1979. Prior to his enrollment in the Ph.D program (integrated program) he was offered an assistantship by the Department of Horticulture at Louisiana State University. He is now a candidate for the degree of Doctor of Philosophy.

Mr. Mamat was married to Faridah on February 13, 1975 and has two children, Afida and Amin.

EXAMINATION AND THESIS REPORT

Candidate: Awang Soh Bin Mamat

Major Field: Horticulture

Title of Thesis: The effect of triacontanol on the growth and development of Tabasco pepper (Capsicum frutescens L.)

Approved:

James L. Fontenot
Major Professor and Chairman

James B. Graynham
Dean of the Graduate School

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Date of Examination:

July 20, 1981